portion and comprising silicon, carbon, nitrogen and hydrogen, with the nitrogen being non-uniformly distributed throughout the diffusion barrier layer, wherein the central portion is substantially devoid of nitrogen."

Independent Claim 7 recites a "semiconductor device comprising a substrate containing conductive elements, and a diffusion barrier layer applied to at least a portion of the substrate in contact with the conductive metal elements, the diffusion barrier layer having an upper surface and a lower surface and a central portion, and comprising silicon, carbon, nitrogen and hydrogen, with the nitrogen being non-uniformly distributed throughout the diffusion barrier layer, wherein the central portion is substantially devoid of nitrogen."

Li et al. appears to disclose a diffusion barrier for semiconductor devices, the diffusion barrier including silicon, carbon, nitrogen and hydrogen. Although Li et al. discloses that copper materials are generally surrounded by nitride-comprising materials to prevent diffusion from the copper materials, or into the copper materials, Li et al. does not disclose or suggest a diffusion barrier having a central portion that is substantially devoid of nitrogen as recited in Claims 1 and 7.

Ibok is concerned with stoichiometric films, that is, films in which the ratio of silicon to nitrogen is 3:4, and non-stoichiometric films. Ibok discloses that although the desirable properties of nitride and oxynitride are the greatest for stoichiometric films, these stoichiometric nitride and oxynitride layers can provide problems in photolithography. Thus, Ibok discloses providing non-stoichiometric films, including graded layers where one portion of the layer can be stoichiometric and another portion can be non-stoichiometric. Ibok discloses that its non-stoichiometric films are manufactured by regulating the silicon:nitrogen ratio, that is, by increasing the flow rate of the silicon-containing precursor, silane, while maintaining the nitrogen and the ammonia flow rates constant. In sum, Ibok discloses increasing the amount of silicon to regulate the silicon:nitrogen ratio while the amount of nitrogen remains the same. Accordingly, it is submitted that Ibok does not disclose or suggest a diffusion barrier that is "substantially devoid of nitrogen" as claimed in independent Claims 1 and 7. Hence, Li et al. and Ibok, alone or in combination, do not disclose or suggest a diffusion barrier

layer having an upper surface and a lower surface and a central portion and comprising silicon, carbon, nitrogen and hydrogen, with the nitrogen being non-uniformly distributed throughout the diffusion barrier layer, wherein the central portion is substantially devoid of nitrogen, as recited in Claims 1 and 7. Claims 2-6 and 8-10 depend from Claims 1 and 7, respectively, and therefore, Claims 2-6 and 8-10 are believed to be patentable over Li et al. and Ibok for at least the same reasons.

With regard to the rejection of Claims 7 and 11-16, Ngo et al. is directed to a semiconductor device having a substrate containing conductive elements and a diffusion barrier applied to at least a portion of the substrate in contact with the conductive metal. Ngo et al., however, does not disclose or suggest a diffusion barrier layer having an upper surface and a lower surface and a central portion and comprising silicon, carbon, nitrogen and hydrogen, with the nitrogen being non-uniformly distributed throughout the diffusion barrier layer, wherein the central portion is substantially devoid of nitrogen, as recited in Claim 7. Further, Li et al. and Ibok do not cure the deficiencies of Ngo et al. for at least the same reasons discussed above.

Therefore, independent Claim 7 is believed to be patentable over Ngo et al., Li et al. and Ibok, alone or in combination. Claims 11-16 depend from Claim 7, and therefore, for at least the same reasons given for independent Claim 7, Claims 11-16 are believed to be patentable over Ngo et al., Li et al., and Ibok.

In light of the foregoing remarks, it is respectfully submitted that this case, containing Claims 1-16 is in condition for allowance. Such early and favorable action is earnestly solicited. If the Examiner has any questions concerning this communication or feels that an interview would be helpful, the Examiner is requested to contact the Applicants' Attorney at the number indicated below.

Respectfully submitted,

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